Project Title: Treatment of Chromite Ore Processing Solid Waste Using a Ferrous Iron Based Reductant

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Problem Definition: Chromite ore processing solid waste generated from ferrochrome alloy production can act as a major source of hexavalent chromium (Cr(VI)) to groundwater. A large volume of chromite ore processing solid waste (consisting of slag, conditioning tower sludge, and electrostatic precipitator dust) measuring approximately 20 acre-feet in size is present in the saturated zone at the Macalloy Corporation site in Charleston, S.C. Groundwater Cr(VI) concentrations in the source area measure as high as 57 mg/L and solid phase Cr(VI) concentrations as high as 550 mg/kg.

Background: In the presence of a strong reducing agent such as sodium hydrosulfite (dithionite), ferrous iron can be stabilized in solution for an extended period of time even under elevated pH conditions. This could prevent pre-mature precipitation of the iron during injection (which may otherwise lead to well and aquifer formation clogging) and allow for effective dissemination of ferrous iron over significant distances within the subsurface. Laboratory batch studies indicated that ferrous iron (as ferrous sulfate) in the presence of sodium hydrosulfite was highly effective in treating the chromite ore processing solid waste sediments while sodium hydrosulfite alone was ineffective. Based on these observations, an *in situ* field pilot study was initiated to evaluate the performance of a combined ferrous iron/sodium hydrosulfite reductant solution in treating the high pH chromite ore processing solid waste sediments in the saturated zone at the Macalloy site.

Objectives: The objectives of the study were to determine whether ferrous iron in the presence of sodium hydrosulfite can be effectively disseminated within the saturated zone Cr(VI) source area at the Macalloy Corporation site and thereby achieve effective treatment of dissolved and solid phase Cr(VI).

Approach: 4500 gallons of a ferrous sulfate/sodium hydrosulfite solution were injected into the source zone through a single injection well screened over 7.5 ft. A series of monitoring wells were installed out radially from the injection well to evaluate the performance of the injected reductant. Groundwater samples were analyzed for multiple parameters including cations, anions, ORP, pH, conductivity, total sulfur, alkalinity, and ferrous iron.

Accomplishments to Date: The results of the field study showed that ferrous iron in the presence of sodium hydrosulfite can be disseminated a significant distance within the saturated zone containing the chromite ore processing waste sediments and can effectively treat dissolved and solid phase Cr(VI).

Near Future Tasks: A preliminary evaluation of findings has been published in the journal *ES&T* (2005, *39*, 6208-6216). Additional publications describing the findings of the study are pending.